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(56) Method for coextrusion thermoformable panels.

(57) A process of co-extrusion is used to obtain a laminate consisting of a central layer made of a mixture of polyolefins and an organic filler, and two external layers made of polyolefins and a mineral filler.

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The present invention relates to a procedure for the manufacture of laminated thermoformable panels that can be easily moulded by thermoforming, enabling them to be used for producing interior panels for vehicle doors, for making trays, containers for packaging, etc. A further object of the invention is a laminated panel obtained by this procedure.

The use of panels made of organic materials and made of polymers with organic fillers, that can be formed by heat, is known in the production of interior panels for vehicle doors, trays and other components consisting of formed panels.

As a result of their structure and the components from which they are made, panels of this type are relatively weak and can easily become deformed and deteriorated by mechanical action. Furthermore, the surfaces of these panels have a finish which makes them unsuitable for direct use, making it necessary to carry out finishing operations to improve the quality or visual appeal.

The object of the present invention is a procedure for obtaining thermomouldable panels which have a different structure and which are made of components that enable levels of quality and characteristics which are superior to those of traditional panels to be achieved.

## DESCRIPTION OF THE INVENTION

According to the procedure of the invention a procedure of co-extrusion is used to obtain a laminate consisting of a matrix or central layer, made of a mixture of polyolefins and organic fillers, and two external layers of polyolefins and mineral fillers, each of which covers one of the surfaces of the central layer.

The matrix or central layer is formed by means of a double-screw counter-rotating extrusion press in which the organic fibres are previously homogenized and gelled pre-mixed with the polyolefins. The external layers are formed at the same time as the central layer by co-extrusion by means of a double-screw co-rotating extrusion press.

The panels can be obtained using polymeric polyolefins such as polythene or polypropylene.

The organic filler may consist of cellulosic fibres or particles.

The mineral filler is preferably made of carbonates or talc in powder form.

The organic or mineral fillers form constituent parts of the respective mixtures in proportions of between 40% and 80%.

The thickness of the central layer and the external layers depends upon the characteristics which the panel is required to have.

The procedure of the invention results in a panel consisting of three layers, one central layer made of a homogenized mixture of polyolefins with an organic filler, and two external layers which cover the surfaces of the central layer and which are made of a homogenized mixture of polyolefins with a mineral filler.

The panels obtained by means of the procedure of the invention can be moulded by thermoforming to adopt the desired final shape, such that said procedure can be used to obtain internal panels for vehicle doors, trays, containers, etc., by means of softening and pressing by thermoforming.

The panels obtained by the procedure of the invention have the following advantages:

a) The incorporation of a homogenous mixture consisting of polymeric particles reinforced with organic fibres into the matrix results in mechanical properties, rigidity and a lower heat transfer coefficient than the polymer itself, making it easier to mould.

b) The co-extrusion of the polymeric mixture with a mineral filler onto the matrix mechanically reinforces the substrate, giving it characteristics which improve its tensile strength, modulus of elasticity and resistance to impact and providing both faces with a plastic finish which, as well as improving the viscosity of the surfaces, making it easier to adhere textile coverings etc., enables it to be designed for direct applications, choosing colours and thereby reducing the cost of the production of articles.

c) The nature of the materials used guarantees their full recyclability. The material obtained by this procedure has the following characteristics: resistance to tension, resistance to bending, coefficient of bending elasticity, absorption of water and coefficient of thermal conductivity.

As has already been pointed out, the panel obtained consists of layers which are different in nature and which complement its mechanical characteristics.

A further advantage of the panel of the invention is that it can be manufactured in a single co-extrusion process using co-rotational and counter-rotational extrusion presses.

There follows an example of an embodiment of a panel obtained by the procedure of the invention.

A panel of three laminas or layers was formed by means of the process described: one central lamina or layer comprising a 50/50 ratio of polyolefins and organic fibre and with a thickness of 1.4 mm, and two external layers or laminas comprising a 60/40 ratio of polyolefins and a mineral filler and with a thickness of

0.5 mm.

The technical characteristics of the laminated panel described above are shown in the following table.

TECHNICAL CHARACTERISTICS			
CHARACTERISTIC	STANDARD	DIRECTION	VALUE
DENSITY	ISO 1183		1.8 g/cc.
DISTORTION TEMPERATURE	ISO 75/A	LONG.	92.5 C. 91.9 C.
RESISTANCE TO TENSION	ISO 8527 STANDARD TEST PIECE I 5 MM/Min.	LONG.	22.3 N/MM2 18.3 N/MM2
BREAKING STRAIN	ISO 8527 STANDARD TEST PIECE I 5 MM/Min.	LONG.	10.1 % 5.8 %
RESISTANCE TO BENDING	ISO 178	LONG.	53.8 N/MM2 46.3 N/MM2
BENDING MODULUS OF ELASTICITY	ISO 178	LONG.	1800 N/MM2 1550 N/MM2
ABSORPTION OF WATER	GNE 80351	LONG.	0.4 %
RESISTANCE TO CHARPY SHOCK	ISO 179		18.5 NJ/M2 18.4 NJ/M2
BALL DROP TEST	GME 80287	23 C. - 30 C.	> 3.0 J > 3.0

#### Claims

1. A procedure for manufacturing laminated thermoflexible panels, characterized in that a process of co-extrusion is used to obtain a laminate consisting of a matrix or central layer made of a mixture of polyolefins and an organic filler, and two external layers made of polyolefins and a mineral filler; said matrix being formed by means of a double-screw counter-rotating extrusion press in which the organic fibres are previously homogenized and gelled pre-mixed with the polyolefins; and said external layers being formed simultaneously by co-extrusion by means of a double-screw co-rotating extrusion press.
2. A procedure according to claim 1, characterized in that the polyolefins used are polymers such as polythene or polypropylene.
3. A procedure according to claim 1, characterized in that the organic filler consists of cellulosic fibres or particles.
4. A procedure according to claim 1, characterized in that the mineral filler is made of carbonates or talc in powder form.
5. A procedure according to claim 1, characterized in that the mixtures of which the central and external layers are made comprise between 40% and 60% organic or mineral fillers.
6. A laminated thermoflexible panel, characterized in that it consists of one central layer made of a homogenized mixture of polyolefins with an organic filler, and two external layers made of a homogenized mixture of polyolefins with a mineral filler, said external layers covering the surfaces of the central layer.



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# EUROPEAN SEARCH REPORT

Application Number  
EP 94 50 0081

DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	DATABASE WPI Week 8950 Derwent Publications Ltd., London, GB; AN 89-367469 & JP-A-01 275 136 (MITSUI PETROCHEM IND KK), 2 November 1989 * abstract *	6
Y	EP-A-0 292 584 (MARIO MIANI) * column 5, line 34 - column 6, line 16; claims 1 4-6 9-1118-20; figures 1-4 *	6 1-5
Y	DATABASE WPI Week 8446 Derwent Publications Ltd., London, GB; AN 84-285330 & JP-A-59 176 045 (KASAI KOGYO KK), 5 October 1984 * abstract *	6 1-5
A	DE-A-40 09 638 (HOECHST AG) * claims 1,6 *	1
A	PE PLAST EUROPE, no. 1, April 1993 MUNCHEN DE, pages 48-52, H. KURRER 'Direct Extrusion of Filled Polyolefins' * page 48, column 2, paragraph 2 * * page 48, column 3, paragraph 2 * * page 49, column 1, paragraph 2 - column 3, paragraph 2 *	1
A	FR-A-2 222 208 (I.C.M.A. SAN GIORGIO S.R.L. ET G.O.R. APPLICAZIONI SPECIALI S.R.L.) * claims 1,11,12,16,17 *	1-4,6
-/-		
The present search report has been drawn up for all claims		
Place of search THE HAGUE		Date of completion of the search 9 June 1995
Inventor Van Nieuwenhuize, O		Examiner
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone Y : particularly relevant if considered with another document of the same category A : technological background D : non-written literature P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>Δ : member of the same patent family, corresponding document</p>		

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Application Number  
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.4)
A	EP-A-0 172 436 (ELASTOGRAM GMBH) * page 1, line 38 - page 3, line 10 *	1-4	
A	US-A-4 746 688 (LEO T. BISTAK ET AL.) * claims 1-24; example 1 *	1-3,6	
A	EP-A-0 319 589 (NAMBA PRESS WORKS CO. LTD.) * page 13, paragraph 2; claims 1,3,7,9,10,12; examples 1-3 *	1-3,6	
A	EP-A-0 540 026 (HIMONT INCORPORATED) * page 3, line 40 - line 43; claims 1-6,10; example 1 *	6	
A	EP-A-0 165 093 (CLEXTRAL) * claim 1; figure 2 *	1	
A	GB-A-1 507 966 (SOLVAY & CIE) * page 3, line 45 - line 54; claims 1-12 *	6	TECHNICAL FIELD SEARCHED (Int.Cl.4)
The present search report has been drawn up for all claims			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>9 June 1995</b>	Examiner <b>Van Nieuwenhuize, O</b>
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : prior art document		T : theory or principle underlying the invention E : earlier patent document, not published on, or after the filing date D : document cited in the application L : document cited for other reasons A : number of the same patent family, corresponding document	

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